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PART XLV CAPACITORS

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PART XLV CAPACITORS

0. FOREWORD

0.1 This Indian Standard (Part XLV) was adopted by the Indian Standards Institution on 19 September 1977, after the draft finalized by the Basic Standards on Electronics and Telecommunication Sectional Committee in consultation with Capacitors Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 With progressive formulation of Indian Standards on many types of capacitors used in electronic equipment, the need for uniform definitions of terms relating to these types of capacitors was felt. With a view to ensuring this and avoiding repetition of these terms and definitions in individual standards, this standard has been prepared.

0.3 This standard is one of a series of Indian Standards on electrotechnical vocabulary. A list of standards so far published in this series, related to electronics and telecommunication is given on page 18.

0.4 While preparing this standard attempt has been made to follow as far as possible, the definitions proposed by IEC in their publication No. 40(IEV 516) (Sectt) 322 'Draft definitions for the inclusion in IEC Publication 50: International Electrotechnical Vocabulary. Chapter 516: Capacitors and resistors for electronic equipment'.

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1. SCOPE

1.1 This standard (Part XLV) covers terms and definitions relating to capacitors, fixed and variable.

2. GENERAL

2.1 Admittance — The current flowing in a circuit divided by the terminal voltage. It is the reciprocal of the impedance.

2.2 Complex Admittance — A complex quantity having the scaler value of the admittance as its modulus and the phase displacement between voltage and current as argument. The argument is positive when the current leads the voltage.

2.3 Inductive Reactance — The product of the inductance and the angular frequency.

2.4 Capacitive Reactance — The reciprocal (with negative sign) of the product of the capacitance and the angular frequency.

2.5 Effective Reactance — The component of the voltage in quadrature with the current, divided by the current.

2.6 Impedance — The terminal voltage of a circuit divided by the current flowing through it.

2.7 Complex Impedance — A complex quantity having the scalar value of the impedance as its modulus and the phase displacement between current and voltage as its argument. The argument is positive when the voltage leads the current.

2.8 Conductance — The component of current in phase with the terminal voltage of a circuit, divided by that voltage.

2.9 Susceptance — The component of admittance which is due to capacitance.

Note — The terms covered in **2.1** to **2.9** are applicable for sinusoidal current only.

2.10 Category Dissipation — The maximum allowable dissipation under continuous load at an ambient temperature equal to the upper category temperature and is normally expressed as a percentage of the rated dissipation.

2.11 Dissipation Factor (δ) — The ratio of resistance to reactance. It is the reciprocal of the Q-factor and may be expressed as a percentage.

2.12 Maximum Dissipation — The dissipation which can be applied to a capacitor for an extended period of time in still air at a defined temperature.

2.13 Rated Dissipation — The maximum allowable dissipation at a specified ambient temperature under the conditions of the electrical endurance test at the same temperatures and which will result in a change in parameters not greater than those specified for this endurance test.

2.14 Duty Cycle — The ratio of the time during which a device operated during one cycle and the duration of that cycle.

2.15 Rated Duty Cycle — The duty cycle for which the capacitor is designed.

2.16 Category Temperature Range — The range of ambient temperatures, at which a capacitor may be operated continuously. It is indicated by the lowest and highest temperature of the range.

2.17 Lower Category Temperature — The minimum ambient temperature for which the capacitor has been designed to operate continuously.

2.18 Upper Category Temperature — The maximum ambient temperature for which the capacitor has been designed to operate continuously.

2.19 Maximum Surface Temperature — The temperature at the hottest point of the external surface, including the terminations.

2.20 Minimum Surface Temperature — The temperature at the coldest point of the external surface including the terminations.

2.21 Rated Temperature — The maximum ambient temperature at which a capacitor may be operated continuously with the rated voltage applied.

2.22 Variation of Capacitance with Temperature — The variation of capacitance with temperature is expressed either as temperature characteristic of capacitance or as temperature coefficient and temperature cyclic drift of capacitance.

2.22.1 *Temperature Characteristic of Capacitance* — The maximum reversible variation of capacitance produced over a given temperature range within the category temperatures. It is expressed normally as a percentage of the capacitance related to a reference temperature of 27°C.

NOTE — This property applies mainly to capacitors of which the variations of capacitance as a function of temperature, linear or non-linear, cannot be expressed with precision and certainty.

2.22.2 *Temperature Coefficient of Capacitance* — The rate of change of capacitance with temperature measured over a specified range of temperature. It is normally expressed in parts per million per degree Celsius (10^{-6}/°C).

2.22.3 *Temperature Cyclic Drift of Capacitance* — The maximum irreversible variation of capacitance observed at room temperature during or after the completion of a number of specified temperature cycles. It is expressed normally as a percentage of the capacitance related to a reference temperature of 27°C. The conditions of measurements, during or after temperature cycling, a description of the temperature cycle and the number of cycles shall be stated.

NOTE — These two properties (*see* **2.22.2** and **2.22.3**) apply to capacitors of which the variations of capacitance as a function of temperature are linear or approximately linear and can be expressed with a certain precision.

2.23 Isolation Voltage — The maximum peak voltage which may be applied under continuous operating conditions between the terminations and other external conducting parts connected together.

2.24 Rated Voltage — The maximum dc or ac (rms) voltage which may be applied continuously to the terminals of the capacitor at any temperature between lower category temperature and rated temperature.

2.25 Self Capacitance — The capacitance of a capacitor which is not essentially used for its capacitance, normally expressed as an equivalent capacitance connected in parallel.

2.26 Self Inductance — The magnetic flux linked by a closed circuit divided by the current flowing through that circuit.

3. FIXED CAPACITORS

3.1 Capacitance (property) — The ability of a capacitor to store electrical energy.

3.2 Capacitance (Quantity) — The quantity of charge on one of the electrodes of a capacitor divided by the corresponding potential difference between the two electrodes, the influence of any other conductor being negligible.

3.3 Direct Capacitance — The capacitance between two terminals of an electric system with more than two terminals, pertaining to the current path or paths directly connecting the two terminals leaving out of account the current reaching these terminals by way of other terminals.

3.4 Rated Capacitance — The capacitance value indicated upon the capacitor.

3.5 Capacitor — A device consisting essentially of two electrodes separated by an insulating (dielectric) material, its intended characteristic being capacitance.

3.6 AC Capacitor — A capacitor designed essentially for application with an alternating voltage of stated frequency.

3.7 Air Dielectric Capacitor — A capacitor with a dielectric consisting of air.

3.8 Polar Capacitor — A capacitor intended for use with the positive polarity of a direct voltage on the identified terminal.

3.9 Bipolar Capacitor — A capacitor designed to withstand a reversal of the applied direct voltage.

3.10 Paper Capacitor — A capacitor with a dielectric consisting of paper, usually impregnated.

3.11 Power Capacitor — A capacitor intended for use in a power system.

3.12 Pulse Capacitor — A capacitor intended for use with intermittent charges or discharges at high values of the charging or discharging current.

3.13 Non-inductive Capacitor — A capacitor constructed to have the incidental inductance reduced to a minimum.

3.14 Non-polarized Electrolytic Capacitor — Absolute term for bipolar capacitor.

3.15 Radio Interference Suppression Capacitor — A capacitor used for the reduction of interference at radio frequencies caused by electrical/ electronics appliances.

3.16 Self-Healing Capacitor — A capacitor with self-healing properties.

3.17 Self-Healing — The process, after local breakdown of the dielectric, by which the electrical properties of the capacitor are instantaneously and essentially restored to the values before the breakdown.

3.18 Surge Limiting Capacitor — A capacitor intended to limit the maximum voltage across the terminals.

3.19 Mica Capacitor — A capacitor with a dielectric consisting of mica.

3.20 Metallized Capacitor — A capacitor of which the electrodes consist of a metallic deposit (such as obtained by evaporation) on the dielectric.

3.21 Metal Foil Capacitor — A capacitor in which the electrodes consist of metal foils separated by a dielectric of paper or plastic film.

3.22 Guard-Well Capacitor — A primary standard capacitor, fixed or variable for values of capacitance below 1 pF. The guard-ring forms a well in which a Pyrex disk is mounted for the accurate location of the electrode assembly.

3.23 Guard-Ring Capacitor — A standard capacitor with parallel electrodes, one of which is surrounded by a ring held at the potential of that electrode in order to reduce the edge effect.

3.24 Film Capacitor — A capacitor with a dielectric consisting of a plastic or paper film.

3.25 Blocking Capacitor — A capacitor preventing the passage of direct current without materially affecting the flow of alternating current.

3.26 By-Pass Capacitor — A capacitor used to provide a path of comparatively low impedance over a range of frequencies.

3.27 Ceramic Capacitor — A capacitor with a dielectric consisting of a ceramic material.

3.28 Coupling Capacitor — A capacitor intended for the coupling of two or more ac circuits with different dc levels.

3.29 DC Capacitor — A capacitor designed essentially for application with a direct voltage.

NOTE — DC capacitors may not be suitable for use on ac supplies. For other applications, for example, pulse or ac, the operating voltages shall have to be agreed to between the purchaser and the manufacturer.

3.30 Electrolytic Capacitor — A capacitor in which the insulating material between the electrodes of each capacitor element consists of a dielectric film which has been formed on one or both of the electrodes by chemical or electrochemical action in a forming electrolyte. The dielectric film is maintained in working condition by the electrochemical action of a working electrolyte, which is contained between the capacitor electrodes and which also serves to make electrical contact with the outer surface of the dielectric film.

3.31 Capacitor Electrolyte — A current conducting material (liquid or solid) between two electrodes of a capacitor at least one of which is covered by a dielectric film.

3.32 Feed-Through Capacitor (Coaxial) — A capacitor with a central current carrying conductor or the conductor connected with a current carrying rod surrounded by the capacitor element which is symmetrically bounded to the centre conductor and to the outer casing to form a coaxial construction.

3.33 Feed-Through Capacitor (Non-coaxial) — A capacitor in which the supply currents flow through or across the electrodes.

3.34 U-Capacitor — A radio interference suppression capacitor intended for applications where failure of the capacitor would lead to danger of electric shock. These capacitors may only be used on mains up to 120 V.

3.35 X-Capacitor — A radio interference suppression capacitor intended for applications where failure of the capacitor would not lead to danger of electric shock.

3.36 Y-Capacitor — A radio interference suppression capacitor intended for applications where failure of the capacitor would lead to danger of electric shock. These capacitors may only be used on mains up to 250 V.

3.37 Capacitor Element — An indivisible part of a capacitor consisting of electrodes separated by a dielectric.

3.38 Cathode — The negative electrode of polar capacitor.

3.39 Anode — The positive electrode of a polar capacitor.

3.40 Condenser — *See* **3.5**.

NOTE — Condenser is an obsolete term for capacitor and should be deprecated.

3.41 Discharge of a Capacitor — The action bringing the electrodes of a capacitor to the same potential by producing a current between the terminals.

3.42 Discharging Current — The current which flows in the external circuit when a capacitor is discharged.

3.43 Charge of a Capacitor

a) The application of a voltage between the electrodes.
b) The product of the voltage between the electrodes and the capacitance.

3.44 Anomalous Displacement Current — The current in addition to the normal leakage current in a circuit containing a capacitor with an imperfect dielectric after the normal charging or discharging current has become small (*see also* **3.39**).

3.45 Leakage Current — The conduction current flowing through the capacitor when a direct voltage is applied.

3.46 Rated Current — The rms value of the continuous current at rated frequency for which the capacitor is designed.

3.47 Rated Ripple Current — The maximum rms alternating current of specified frequency which may be applied continuously at a stated ambient temperature.

3.48 Dielectric — The insulating material (for example, air, paper, mica, etc) between the electrodes.

3.49 Dielectric Absorption — The property of an imperfect dielectric whereby a part of the electric charges within the body of the material caused by an electric field are returned with delay to that field.

3.50 Dielectric Constant — The ratio of the capacitance of a capacitor with a given dielectric to that of a capacitor with the same electrode arrangement but with a vacuum dielectric.

3.51 Charging Current — The current by which a capacitor is charged.

3.52 Temperature Compensating Capacitor — A capacitor whose capacitance varies with temperature in a predictable and reproducible manner.

3.53 Coupling Impedance of a Feed-Through Capacitor (Coaxial or Non-coaxial) — The output voltage divided by the input current. It is measured with a sinusoidal high frequency voltage, the output being suitably terminated.

3.54 Dielectric Strength — The property of a dielectric which opposes a disruptive discharge. It is measured by the intensity of the electric field which will breakdown the dielectric.

3.55 Earth Terminal — A terminal intended to be connected to earth.

3.56 Edge Effect — The bulging out of the lines of the electric field flux, at the edges of two parallel electrodes, created by a potential difference between the electrodes.

3.57 Electrode — A conductive part connected to a terminal or (when applicable) to the container of a capacitor.

3.58 Farad — The capacitance at which a charge of 1 coulomb produces a potential difference of 1 volt between the terminals.

3.59 Impregnant — A substance intended to fill up the air pockets between the electrodes and in the dielectric film of a capacitor.

Note — In case of aluminium electrolytic capacitors, the impregnant acts as electrolyte.

3.60 Flashpoint of Impregnant — The temperature at which the impregnant starts to produce a flammable vapour.

3.61 Intermittent Operation — Operation in which periods when the capacitor is charged are followed by intervals during which the capacitor is discharged.

3.62 Leyden Jar — A capacitor consisting in its original form of a jar, generally of glass, having conducting surfaces inside and outside.

3.63 Main Resonant Frequency — The lowest frequency at which the impedance of a two terminal capacitor is a minimum with a sinusoidal voltage applied.

3.64 Permittivity — *See* **3.50**.

3.65 Power Factor — The ratio of resistance to impedance.

3.66 Q-Factor — The ratio of the susceptance to the effective shunt conductance at a stated frequency. It is the reciprocal of the dissipation factor.

3.67 Rated Frequency Range — The frequency range for which the capacitor is designed to operate.

3.68 Equivalent Series Resistance — A fictitious resistance which, if connected in series with an ideal capacitor of capacitance value equal to that of the capacitor in question, would result in power loss equal to the active power dissipated in that capacitor at a given frequency.

3.69 Insulation Resistance — The direct current resistance between the two terminals of a capacitor, or between either or both of the terminals and the capacitor case.

3.70 Ripple — The alternating component of a unidirectional current or voltage.

3.71 Category Voltage — The maximum voltage which may be applied to a capacitor at its upper category temperature.

3.72 Rated Ripple Voltage — The rms value of the maximum alternating voltage of a specified frequency that may be applied continuously to the capacitor at a specified temperature.

3.73 Residual Voltage — The voltage caused by dielectric absorption that remains on the capacitor terminals after the capacitor is discharged and then left with the terminals disconnected.

3.74 Surge Voltage or Current — A transient voltage or current of large magnitude and short duration, such as caused by discontinuity in a circuit.

3.75 Surge Voltage Ratio — The quotient of the maximum peak voltage at the terminals of the capacitor permitted during a specified time at a specified temperature within the category temperature range and the rated voltage or temperature derated voltage (as applicable).

3.76 Tangent of Loss Angle (Tanδ) — The ratio of the ohmic resistance and the impedance at a sinusoidal voltage of specified frequency.

3.77 Temperature Derated Voltage — The maximum voltage that may be applied continuously to the terminals of a capacitor at the stated temperature between the rated and the upper category temperature.

3.78 Time Constant — The product of the insulation resistance and the capacitance of a capacitor, expressed in seconds.

4. VARIABLE CAPACITORS

4.1 Variable Capacitor — A capacitor which is designed to enable the capacitance to be varied continuously over its complete range.

4.2 Rotary Variable Capacitor — A capacitor with a rotatable electrode which enables the capacitance to be varied continuously over its complete range.

4.3 Effective Angle of Rotation — The angle (or number of turns) through which the rotor moves between the positions of maximum and minimum capacitances.

4.4 Nominal Angle of Rotation — The angle used for determining the measuring points when capacitance law measurements are made.

4.5 Total Angle of Rotation — The angle (or number of turns) through which the rotor moves between the end stops. If there are no end stops, then the total angle of rotation is the effective angle of rotation.

4.6 Backlash — The difference in capacitance (expressed as a ratio) obtained at a specified measuring angle when the actuating device is moved to approach the measuring angle from a clockwise and then from an anticlockwise direction.

4.7 Capacitance Drift After Adjustment — The change in capacitance (expressed as a ratio) obtained in a stated time after the actuating device has been rotated at a specified speed to a stated capacitance.

4.8 Capacitance Law — The relationship between capacitance and the position of the actuating device.

4.9 Maximum Capacitance — The value which is obtained with the actuating device adjusted in the manner prescribed in the relevant specification.

4.10 Minimum Capacitance — The value which is obtained with the actuating device adjusted in the manner prescribed in the relevant specification.

4.11 Capacitance Swing — The difference between the maximum and the minimum capacitance values.

4.12 Differential Capacitor — A capacitor comprising two isolated stators, which are operated with one rotor, arranged so that as the capacitance between the rotor and one stator increases, the capacitance between the rotor and the other stator decreases but the sum of the two capacitance values remains substantially constant at all settings.

4.13 Multi-section Capacitor — A capacitor which has several sections, the capacitance values of which are varied simultaneously by a common actuating device.

4.14 Section — A stator and its corresponding rotor.

4.15 Matching Section — A section matched to a reference section.

4.16 Reference Section — That section to which other sections are matched.

4.17 Split Stator Capacitor — Two isolated stators which function in series with a common rotor.

4.18 Adjustable Capacitor — One or more capacitor elements or unit capacitors so arranged within a single enclosure that the capacitance can be adjusted in steps by means of movable links or continuously.

4.19 Padding Capacitor — A small adjustable capacitor for fine adjustment of capacitance as in a filter or a series of tuned circuits.

NOTE — These capacitors are also known as podders.

4.20 Preset Capacitor — A capacitor used specifically as a preset capacitor where a comparatively small number of movements are required during its life.

4.21 Trimmer Capacitor — A capacitor used for trimming or for other similar purposes where the amount and duration of movement of the rotatable electrode is considerably less than that of tuning capacitor.

4.22 Tuning Capacitor — A capacitor which is intended to be operated frequently throughout its life, when used for tuning purposes. The capacitor may be provided with a control spindle to which a knob or drive may be fitted.

4.23 Rotor Contact Resistance — The resistance between the rotor contact terminal and the rotor shaft measured when the spindle is rotated through the total angle of rotation.

4.24 Style — The method of varying the capacitance.

NOTE — A style comprises products of the same functional types having similar means of varying the capacitance.

4.25 Style 1 (Concentric) — An air dielectric variable capacitor where the capacitance can be varied by the axial movement of a rotor in a stator.

4.26 Style 2 (Vane) — A variable capacitor where the capacitance can be varied by rotating the rotor vanes between the stator vanes.

4.27 Style 3 (Tubular) — A solid dielectric variable capacitor where the capacitance can be varied by the axial movement of an electrode within a tube.

4.28 Style 4 (Compression) — A solid dielectric variable capacitor where the capacitance can be varied by compressing a stack of electrode and dielectric layers.

4.29 Style 5 (Disk) — A solid dielectric variable capacitor where the capacitance can be varied by rotating a metal or metallized disk.

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(Part III/Sec 1)-1965 Part III Acoustics, Section 1 Physical acoustics
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